

## TEST EFFECTIVENESS TREND OBSERVATION

### Effectiveness of Galileo Assembly Level Dynamics Tests versus Number of Axes Tested\*

#### CONCLUSION:

Based on Galileo experience, vibration testing of assemblies in two axes are required to detect potential design/workmanship defects. Performing one axis of vibration will in general leave many design/workmanship defects undetected.

#### DISCUSSION:

Galileo assembly level Problem/Failure Reports (PFR's) were reviewed to establish the relative effectiveness of assembly level dynamics tests versus the number of axes tested. A total of 66 PFR's were written on Galileo, of which 45 were classified as *failures* and the remainder as *problems*.

Available assembly environmental test reports were reviewed to establish the number of axes tested prior to assembly failure. Test reports were located for only those assemblies tested at JPL. Based on these reports the test sequence leading up to failure for 14 of the 45 assembly failures was determined, Table 1.

Test Environment vs Type of Failure by Axis		Number of Failures			
Test Environment	Type of Failure by Axis	Design		Workmanship	
		1st	2nd	1st	2nd
Sine Vibration	1st	3	1	0	4
	2nd	4	1	2	7
	3rd	0	0	0	0
Random Vibration	1st	1	1	0	2
	2nd	2	0	0	2
	3rd	0	0	0	0
Total		10	2	2	14

Table 1 - Dynamic Assembly Test Failures by Known Order of Occurrence

\*This trend report analysis is just Galileo dynamic test effects. A survey of other test performance is planned to shed additional insight into these effects. A revised trend report, if appropriate, will be issued when the survey is completed.

In reviewing the available assembly test reports, it was found that sine vibration testing was performed first almost without exception, followed by random vibration testing. Vibration testing was performed on all three axis for Galileo assemblies. The order in which vibration testing was performed on each axis (x,y,z), however, varied from one assembly to another. Table 1 shows that a majority of the failures, for this data subset, occurred during the second axis of vibration testing, followed by the first axis, and with none found in the third axis.

The following conclusions may be drawn:

- 1) Performing only one axis of vibration will in general leave many design/workmanship defects undetected.
- 2) Performing the third axis of vibration may reveal few additional defects.